

286 493

63-1-2

HUMAN ADAPTATION

TO ANTARCTIC

286493
STATION LIFE

PAUL D. NELSON

REPORT NO: 62-12



U. S. NAVY MEDICAL
NEUROPSYCHIATRIC RESEARCH UNIT

SAN DIEGO 52, CALIFORNIA

BUREAU OF MEDICINE AND SURGERY NAVY DEPARTMENT
WASHINGTON 25, D. C.

Human Adaptation to Antarctic Station Life^{1, 2}

Lieutenant Paul D. Nelson, MSC, USN

U. S. Navy Medical Neuropsychiatric Research Unit

San Diego, California

Introduction

Following five decades of inspiring exploration by such men as Amundsen, Scott, Shackleton, and Byrd, The United States began in 1955 to build several permanent stations in the Antarctic, one of which was located at the geographical South Pole. By 1957 this country operated seven such stations as a participant nation in the International Geophysical Year, and at present we maintain four permanent stations throughout the year in this coldest of all continents.

In addition to fostering an international spirit of cooperation, the primary objective of all activity in the Antarctic is of course to gather scientific information. To assist The Office of Antarctic Programs in its scientific endeavors, The United States Navy has contributed equipment and personnel for support in the form of transportation, supply, construction,

¹U.S.N. Med. N.P. Res. Unit Report Number 62-12, June 1962, supported by the Bureau of Medicine and Surgery, Department of the Navy under Research Task MR005.12-2004, Subtask 1.

²The present paper was submitted as a working paper for the Conference on Medicine and Public Health in the Arctic and Antarctic held in Geneva, Switzerland from 28 August to 1 September, 1962 under the direction of the World Health Organisation. The opinions expressed are those of the author and are not to be construed as necessarily reflecting the endorsement of the Navy Department.

and maintenance. Since 1956 the Navy's Bureau of Medicine and Surgery has also been involved in the Antarctic program for the purposes of conducting physical and psychiatric screening of volunteers and of carrying out a continuous research program concerning the physiological and psychological adaptation of man to the rigors of Antarctic life.

The present paper is devoted to a discussion of the psychological research efforts to date. Discussion of human adaptation to any environment must entail both an understanding of the environmental demands and the human response systems which seem most salient and relevant to such demands. With this in mind, initial consideration will be given the ecological aspects of Antarctic station life, followed by a discussion of adaptation criteria and their correlates.

Antarctic Station Ecology

Demands of the physical environment vary in the Antarctic with time of year and station location. Outdoor temperatures can range from 30 to -100 degrees Fahrenheit; altitudes range from sea level to 9,600 feet above sea level; and the period of total darkness experienced during the Antarctic winter months can range from approximately two to six months. At every station the men must perform heavy work continuously through the sunlit summer months, receiving and storing supplies and constructing and repairing station facilities for the winter ahead. With the advent of winter, most activity moves indoors, supply replenishments cease, and except for radio communication the men at each station are isolated from the outside world for the following six months.

The number of men who remain at the stations through the winter varies

from about fifteen to one hundred and fifty. Station size varies accordingly. At the smaller stations of twenty-five men or less the relatively restricted opportunity for stimulus variety, either physical or social, produces a most unique set of demands upon each individual. The intensity of demands produced by this physical and social confinement of the small station is increased by the necessary occupational differences among small station personnel with the concomitant personality and cultural differences.

At the smaller stations approximately half the personnel are civilian specialists from the fields of meteorology, physics, glaciology, geology, and electronics. The remainder of station members are Navy personnel with such occupations as radio operator, cook, carpenter, plumber, mechanic, electrician, and physician. At each such station there is one civilian supervisor and a Navy officer designated as station leader; in recent years the officer has usually been a physician. The larger stations are composed of many more personnel from similar occupational fields.

A few of the demographic characteristics of both Navy and civilian personnel are presented in Table 1 (Appendix). These statistics are based upon summer support, wintering-over, large, and small station personnel. As a group, civilians have been somewhat older than Navy personnel, although less so in recent years. In fact, among the past two years of small station personnel, the median age for civilians was 26 while that for Navy personnel was 28 years of age. By the nature of their occupations, Navy personnel generally have had less formal education but more job experience than their civilian colleagues. In other regards, Navy

personnel are more likely than civilians to have been raised in a rural environment and in larger families. Both groups have been similar in terms of religious background and marital status.

Criteria of Adaptation

Of greatest importance in our consideration of human adaptation is the physical and emotional health of each individual. Although there have been instances of great emotional stress, it has been heartening that no documented psychiatric breakdowns of psychotic proportion have occurred among our wintering-over personnel since the initial psychiatric screening (Nardini, Herrmann, and Rasmussen, 1961). While we need more information about individual baselines of response, there have been consistent reports that insomnia, headaches, mild depression, irritability, and sensitivity to physical and social stimuli increase with the onset of winter, but with individual differences sufficient to warrant the use of such symptoms as indices of emotional adaptation (Mullin and Connery, 1959; Rohrer, 1959).

It is suspected that aspects of the immediate environment, such as work load and social boundaries of station life, are more critical for the development of emotional response variation than the fact that these men are isolated from the outside world. For one thing, most of the Navy and civilian personnel are in occupations such that they can expect rather routinely to be assigned to jobs away from home and normal community life. In addition, the desire for privacy has been more frequently reported than a desire for greater social contact, suggesting the impact of continuous face-to-face living conditions. And, while the onset of winter

is accompanied by a realization that there is no way out for six months, the increased incidence of emotional and somatic complaint associated with the advent of winter appears most related to the reduction in work load and increased physical and social confinement. Therefore, in addition to studying emotional response as a criterion of adaptation, we have focused upon the individual's ability to perform his work and to get along with other group members as two other meaningful criteria of adaptation.

Since each individual goes to the Antarctic to get a particular job done, adequacy of work performance seems to be a rather logical criterion of adaptation. For the civilian this means the ability to carry out the scientific program; for the Navy personnel this implies the execution of skills upon which the survival of the entire station may depend. Since there is no single concrete goal against which the work performance of all station members can be evaluated, work performance has been primarily assessed through ratings of proficiency and industriousness given by the individual's station leaders and peers. Adequate reliability has been demonstrated for these evaluations (Nelson and Gunderson, 1962). At the present time, more detailed information is being obtained about the specific variations in work demands for different occupational specialists. Our future evaluations of work performance may therefore reflect to a greater extent than at present the individual's job adaptation relative to the unique demands imposed upon a person in his occupation.

The third criterion of adaptation to Antarctic station life is the ability of the individual to adjust to the other station members, a

demand most intense at the relatively small stations. While being similar to personal likeability, this capacity pertains to an ability to be tolerant of and sensitive to the idiosyncracies of others to the extent that one's own behavior will not have a disruptive effect upon other station members. There has, for example, been evidence suggesting that it matters little whether an individual is essentially withdrawing or outgoing in relation to other station members so long as he does not annoy, irritate, or cause dissension among others (Mullin and Connery, 1959). As with the ability to do one's job, social adaptation has been assessed primarily in terms of station leader and peer ratings on the individual's ability to get along with others; and again, these evaluations appear reliable (Nelson and Gunderson, 1962).

On face value and in terms of their correlation with independently obtained evaluations of general adaptation, such as "what is your overall opinion of this man" or "would you like to return to the Antarctic again with this man", emotional, work, and social adaptation are all important (Nelson and Gunderson, 1962). There has been evidence, however, that social adaptation becomes increasingly important during the latter part of the year (Nelson and Gunderson, 1962). Furthermore, in regard to emotional response variation, recent data suggest that anxiety level and emotional control are more likely to have an effect upon social adaptation than upon such indices of task performance as alertness and industriousness. This may simply mean that responses suggestive of emotional stress are more likely to be observed in social than in task settings, but it could also imply that social situations are more likely

to trigger such response systems. More information is needed.

While the emphasis to this point has been on the individual, we are also interested in studying the extent to which station groups differ in the composite adaptation of their members. Relative rates of emotional change and psychosomatic complaint, the extent to which station members are mutually accepting of one another, and group member attitudes towards their own work achievements and those of others are being considered as criteria for the comparison of station groups.

Correlates of Adaptation

Although we have attempted to measure adaptation with ratings of modal performance, we must bear in mind that adaptation is a dynamic process and not necessarily an end state. This is particularly true for a prolonged living situation. Thus, when we begin to discuss prediction of adaptation, we should probably do well to think of the problem in terms of correlates of adaptation levels changing through time; such correlates would consist of those attributes which the individual brings into the situation as well as the situational elements he encounters and the ways in which these two systems operate in a transactional setting. While this is the direction of our current thinking, our past studies of adaptation correlates have been predominately of an independent-dependent variable design.

The best single correlate of adaptation to date has been the summary evaluation of the Antarctic volunteer made by the psychiatrist and psychologist at the time of screening. Significant correlations between the psychiatric evaluation and overall evaluation of adjustment made by station

leaders have been consistently obtained (Nardini, Hermann, and Rasmussen, 1961). Of particular importance to the examining psychiatrist and psychologist have been the individual's ability to direct hostility inward and relatively low levels of general anxiety and aggressive feeling (unpublished data).

Demographic characteristics such as age, education, and family background have been correlated one at a time with measures of adaptation but with few consistent significant results. Age, for example, has been found to be negatively related to a measure of motivation, positively related to an absence of psychosomatic complaint (Weybrew et al, 1961), and positively related to overall adjustment (McGuire and Tolchin, 1961). Among small station personnel for the past two years, however, there has been no linear relationship between age and overall adjustment; there has been a tendency for persons closest to the median age to do somewhat better than either the relatively young or old members of the group and for younger station members to be more variable in their adjustment levels. While there have been no striking differences in adaptation evaluations given in recent years to civilian and Navy personnel, there has been a trend suggesting that men from rural background, men who are single, and men who have had previous work experience outside The United States do somewhat better than others.

Other than the observations made at screening by the psychiatrists and psychologists, few personality data have been gathered in past years. Those which have been obtained suggest that autonomy, or low dependence on others, is positively correlated with overall adaptation (Smith, 1961)

and similarly with low incidence of emotional change or medical complaint (unpublished data). Since the personality is a striving reward-seeking system, a more fruitful approach in the future study of personality and adaptation would seem to be one which accounts for the environmental demands made of the individual as well as the behavioral tendencies that the individual carries into the life situation. In some work roles, for example, certain personality characteristics might be more functional than others. In regard to the social environment, the personality characteristics of persons with whom the individual interacts would be important in determining the extent to which the individual's own attributes are adaptive. The latter possibility seems particularly valid in view of the previously reported observation that a particular type of interpersonal relationship is of secondary importance to an ability to avoid annoying, irritating, or causing dissension among others. The extent to which station members are similar and different in personality and value systems is expected to be not only related to the adaptation potential of any one individual but also to the mutual compatibility of the entire station group.

In addition to the considerations just given to group composition, certain aspects of group structure, such as leadership style, are expected to be correlates of the adaptation process particularly in the study of group differences. Again, it is likely that the effectiveness of any particular structure may depend upon the nature of the predominant task at hand and the characteristics of the individuals directly involved. In studying leadership style, for example, we have found that of two

stations with approximately twenty men each the station with the more democratic, as opposed to autocratic, leadership orientation was also characterized by greater feelings of achievement, efficiency, and social compatibility among its members; in contrast, the opposite effect was observed for two stations each with approximately forty members (Gunderson and Nelson, 1962 b). In this instance there was apparently an interaction effect between leadership style and group size.

Other correlates of adaptation yet to receive our attention in a longitudinal study are such aspects of the environment as climate, altitude, amount of space in which the individual must live, and the physical proximity of station activity areas such as eating, sleeping, work and recreational spaces. Since the stations themselves differ in regard to conditions as these, their effect upon adaptation must be assessed and controlled if station differences are to be related to other variables. Such control may be exercised through statistical design, but may also be achieved to some extent by comparing the different groups that winter-over at the same station and which therefore from year to year share a similar physical environment.

Summary

Adaptation to the demands of Antarctic station life has been considered in terms of an ongoing process of emotional, work, and social adjustment. To date, most of our research efforts have been directed towards developing meaningful and reliable measures of such adaptation for the purpose of comparing individuals and station groups. While more effort is yet needed in measuring adaptation as a process rather than as

an end state, even greater efforts will be required in future studies of correlates of adaptation. The demographic and personality attributes of station members, the specific work roles of individuals, the group structure, and the demands of the physical environment must be considered relative to one another over time before a more thorough understanding of human adaptation will be achieved.

Appendix Table 1

Demographic characteristics of United States Antarctic personnel in years 1957-58 and 1960-61 comparing Navy with civilian personnel.

<u>Characteristics</u>	<u>1957-58</u>		<u>1960-61</u>	
	<u>Navy</u>	<u>Civilian</u>	<u>Navy</u>	<u>Civilian</u>
Number of personnel ^a	393	79	579	156
<u>Years of age</u>	<u>(percentages)</u>		<u>(percentages)</u>	
19 or less	15.0	1.3	7.1	1.3
20 - 23	30.5	15.2	29.0	20.5
24 - 27	20.1	22.8	20.0	30.8
28 - 31	16.5	24.1	18.7	17.9
32 - 35	10.2	7.6	15.2	16.0
36 or more	7.6	29.2	10.0	13.4
<u>Marital status</u>				
single	60.6	54.4	47.3	59.0
married	32.8	40.5	44.6	38.5
separated/divorced	6.6	5.1	8.1	2.4
<u>Years of education</u>				
12 or less	80.9	12.7	78.7	10.9
13 or more	19.1	87.3	21.3	89.1
<u>Years of job experience</u>				
5 or less	55.2	68.4	43.5	75.6
6 or more	44.8	31.6	56.5	24.4
<u>Hometown background</u>				
rural	37.6	19.0	33.0	17.3
town (<100,000)	45.8	52.0	48.5	62.2
city (>100,000)	16.5	29.1	18.5	20.5
<u>Number of siblings</u>				
two or less	47.0	64.6	43.7	62.2
three or more	53.0	35.4	56.3	37.8
<u>Religion</u>				
Protestant	74.3	63.3	72.2	64.1
Catholic	21.6	25.3	23.7	15.4
Jewish	0.5	3.8	0.9	3.8
Other	1.3	1.3	1.9	3.2
None	2.3	6.3	1.4	12.8

^a Number of persons on whom demographic data have been available.

References

- Gunderson, E.K.E., & Nelson, P. D. Adjustment criteria in Antarctica. U.S. Navy Med. N.P. Res. Unit, San Diego, California, Report No. 62-1, March, 1962, (a).
- Gunderson, E.K.E., & Nelson, P. D. Attitude changes in small groups under prolonged isolation. U.S. Navy Med. N. P. Res. Unit, San Diego, California, Report No. 62-2, March, 1962, (b).
- McGuire, F. & Tolchin, S. Group adjustment at the South Pole. J. Ment. Sci., 1961, 107, No. 450, 954-960.
- Mullin, C. S. Jr. & Connery, H.J.M. Psychological study at an Antarctic IGY station. U.S. Armed Forces Med. J., 1959, March, 260-296.
- Nardin, J. E. , Herrmann, R. S., & Rasmussen, J. E. Navy psychiatric assessment program in the Antarctic. Amer. J. Psychiat. 1962, August, 97-105.
- Nelson, P. D. & Gunderson, E.K.E. Analysis of adjustment disorders in small confined groups. U.S. Navy Med. N.P. Res. Unit, San Diego, California, Report No. 62-3, March, 1962.
- Rohrer, J. H. Human adjustment to Antarctic isolation. Naval Research Reviews, June 1959, 1-5.
- Smith, W. M. Scientific personnel in Antarctica: Their recruitment, selection, and performance. Psychological Reports, 1961, 9, 163-182.
- Neybrow, B. B., Molish, H.B. & Youniss, R.P. Prediction of adjustment to the Antarctic. U.S. Naval Med. Res. Lab., New London, Connecticut, Vol. XX, No. 1, Report No. 350, April, 1961.